



FS & BLM Large Scale Monitoring Efforts



Goal: Assess Effects of Current Mgmt Direction

- ★ Use 6th field watershed as sample unit
- ★ 5 year rotating panel design
- ★ Sample stream reaches
- ★ Biological and physical variables similar to EMAP
- ★ Just beginning analyses



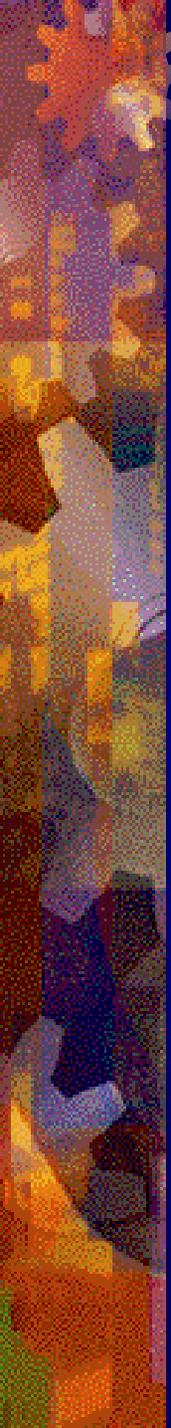
Upper Columbia River Basin Effort

- ✦ Rick Henderson
- ✦ Eric Archer
- ✦ Jeff Kershner
- ✦ Brett Roper



Charges as Land Management and Regulatory Agencies.

- ★ To describe the complexity of streams and their watersheds.
- ★ To understand the relationship between management activities and the conditions of basins, watershed, and streams.
- ★ To recommend management changes that address and protect short and long-term public desires/federal laws.



Study Design

- ✦ 4000 6th field HUC's
- ✦ Stratified into Managed and Reference
- ✦ Sample 1250 in 5 years
- ✦ Sample Integrator Reach
- ✦ Reference =
 - ✦ Minimally managed
 - ✦ Watershed vs reach
 - ✦ Don't use best available

General model of stream habitat change.

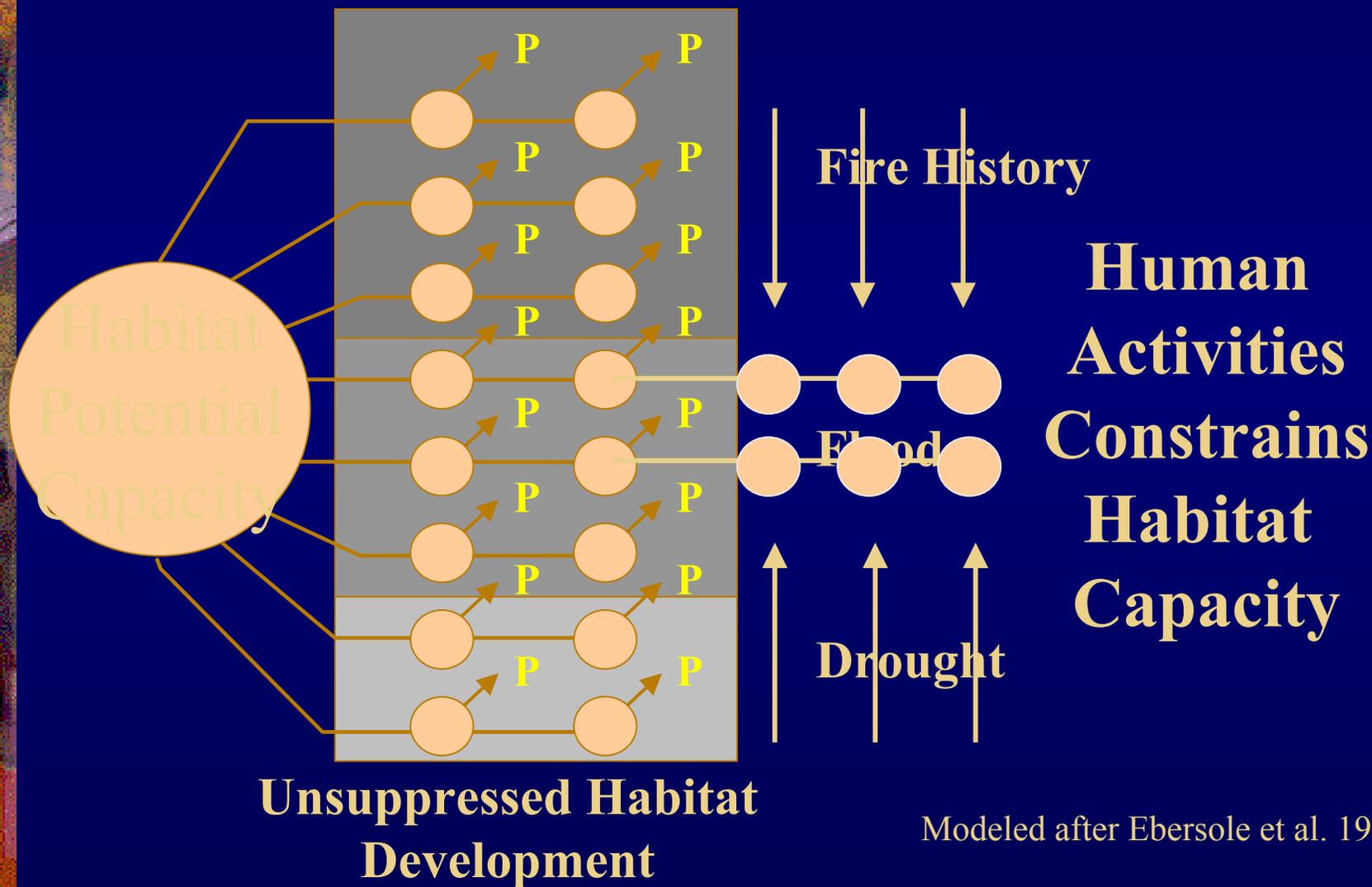


Different Mean

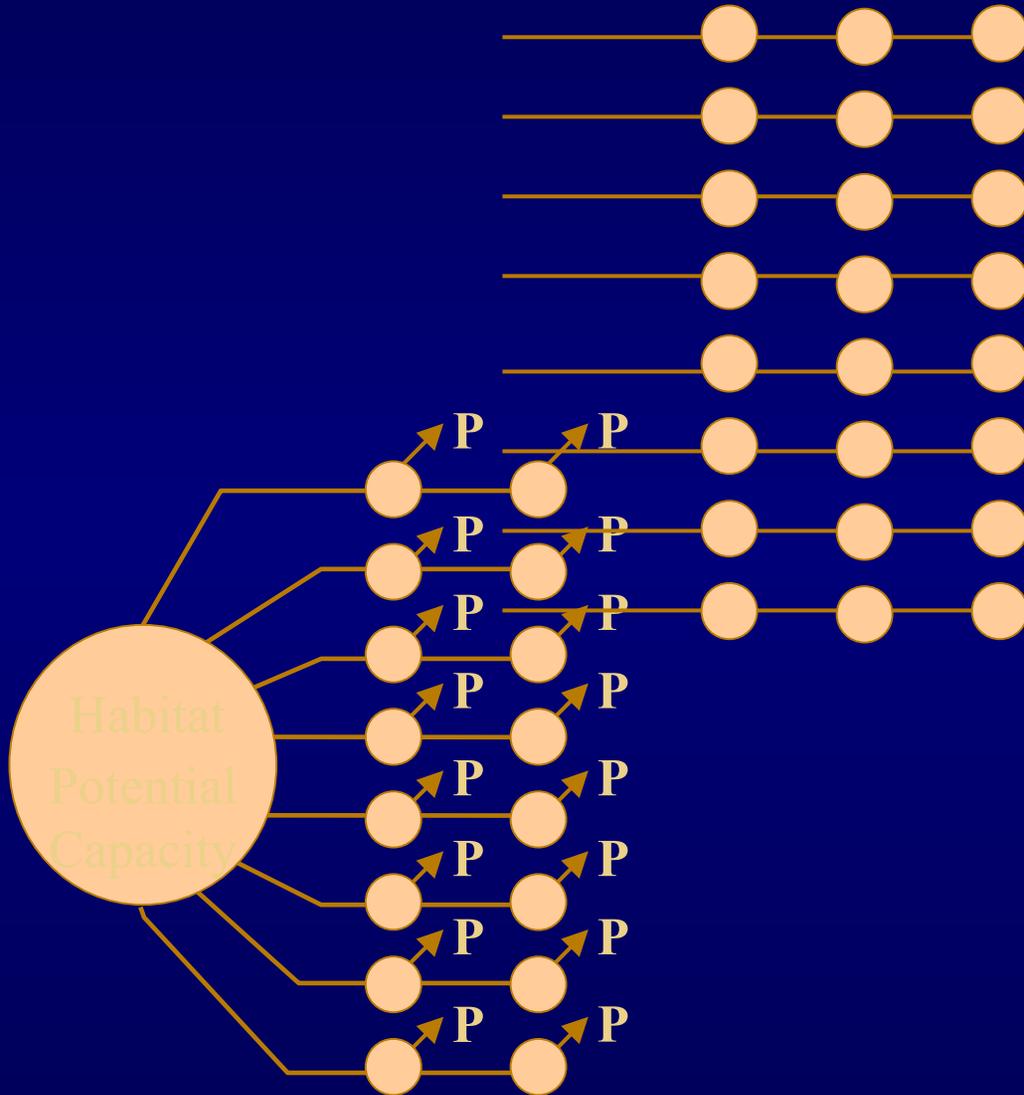
Same Variance

Likely changes biota

Understanding the Relationship Between Management Activities and the Conditions of Basins, Watershed, and Streams.



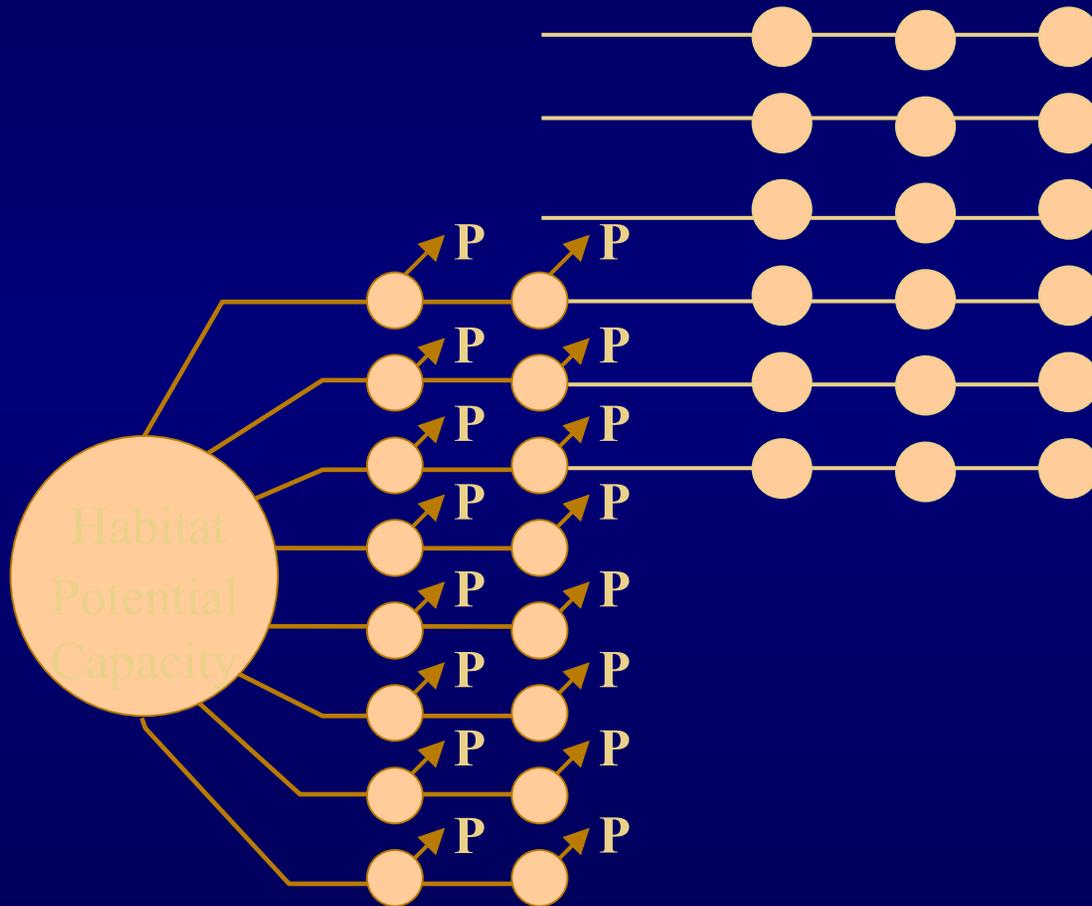
Alternative Response



Human
Activities
Alters
Habitat
Capacity

Unsuppressed Habitat Development

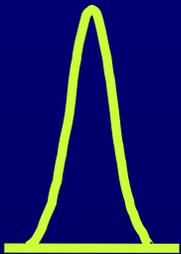
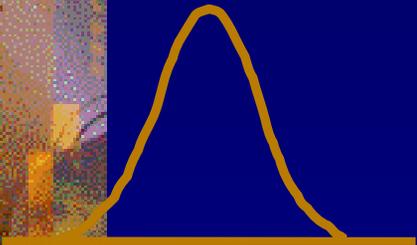
Alternative Response



Human
Activities
Alters and
Constrains
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Unsuppressed Habitat Development

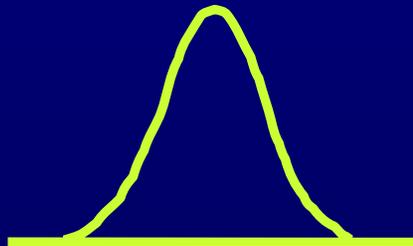
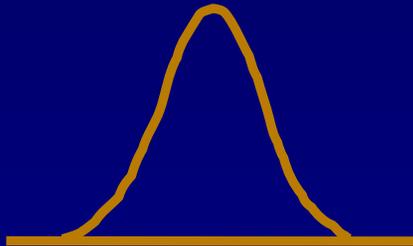
Effects of These Three Realities On Statistical Test



Same Mean

Different Variance

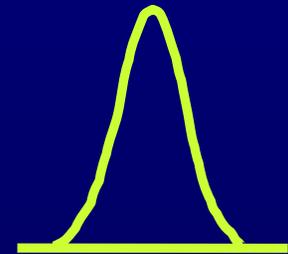
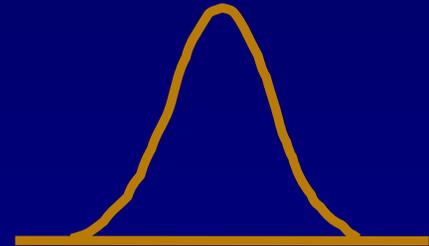
Likely changes biota



Different Mean

Same Variance

Likely changes biota



Different Mean

Different Variance

Likely changes biota

What should we manage stream conditions towards?

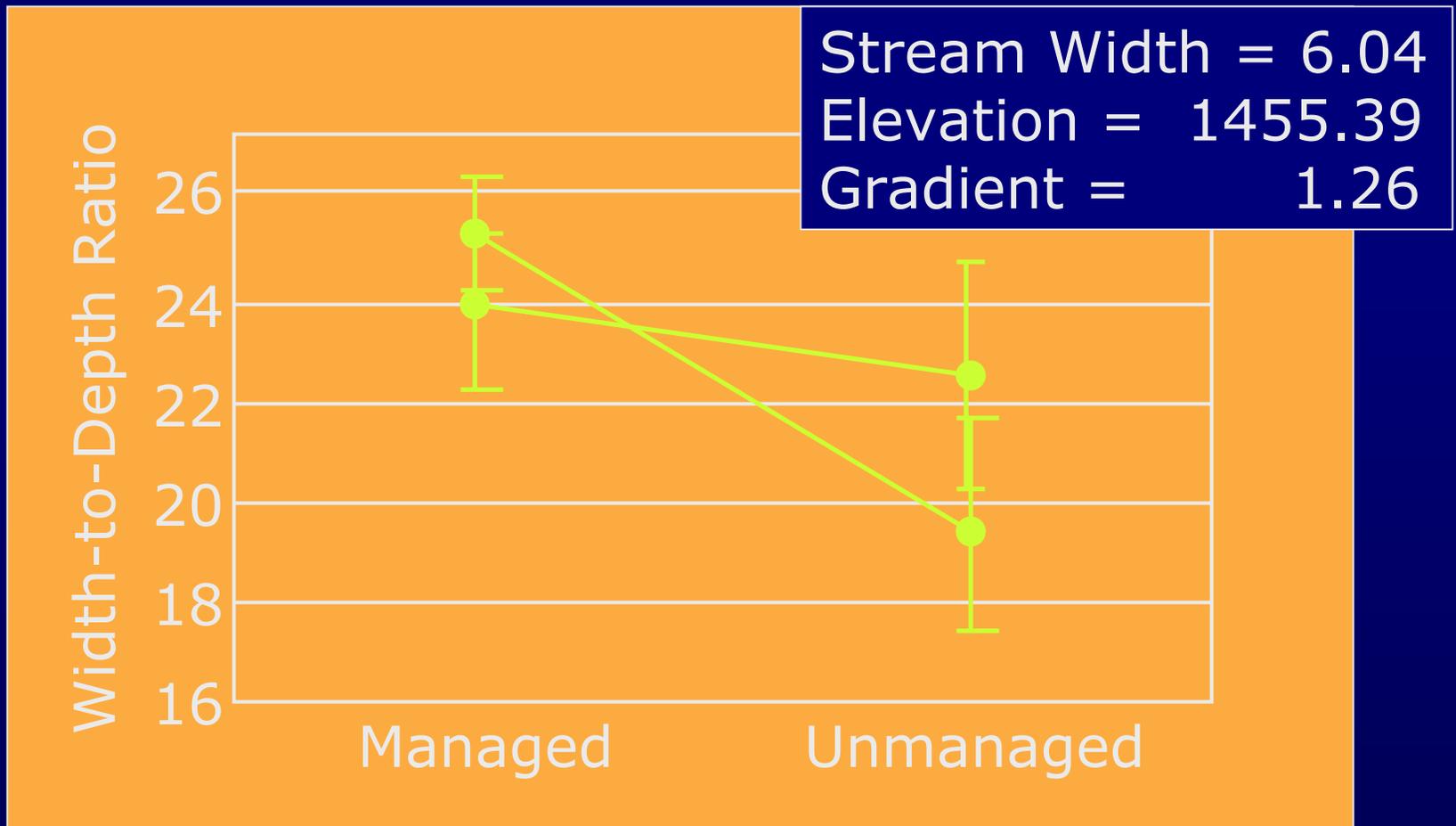
Characteristics of Minimally Managed and Unmanaged Watersheds Within the Upper Columbia River Basin

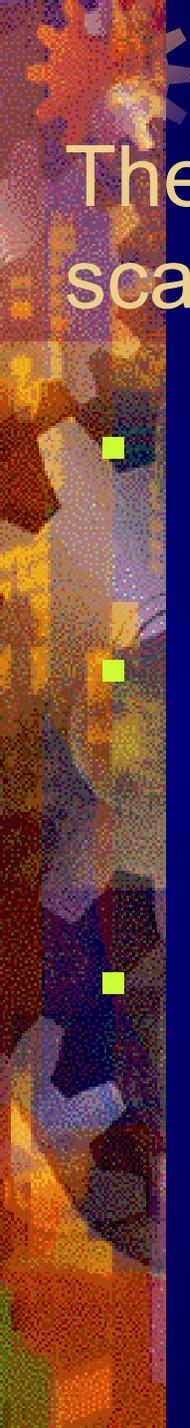
| Variable | Managed Mean (STD) | Unmanaged Mean (STD) | p-value Mean (STD) |
|----------------|-----------------------|-------------------------|-----------------------|
| Elevation | 4576.70 (1333.4) | 5443.99 (1384.9) | <0.001 (0.679) |
| Gradient | 1.27 (0.702) | 1.20 (0.718) | 0.526 (0.798) |
| Sinuosity | 1.34 (0.314) | 1.42 (0.384) | 0.106 (0.370) |
| Area | 39.87 (28.57) | 31.32 (25.69) | 0.304 (0.316) |
| Stream width | 5.67 (2.943) | 6.69 (4.088) | 0.004 (0.001) |
| Stream Density | 1.58 (0.654) | 1.57 (0.936) | 0.871 (<0.001) |
| Road Density | 1.60 (1.109) | 0.15 (0.392) | <0.001 (<0.001) |
| % Federal | 95.40 (7.74) | 99.84 (0.665) | <0.001 (<0.001) |
| Precipitation | 810.26 (302.6) | 1013.63 (284.3) | <0.001 (0.561) |

n=203

n=67

So how are we evaluate departure from those conditions?





The next frontier – The real need for large scale monitoring programs

- Predict rates attributes change under unmanaged and managed conditions.
- Be able to discern between natural changes and the accelerated or decelerated rates of change due to anthropogenic effects.
- Provide context for the endpoints towards which society wants individual streams, watersheds, and basins be managed towards.



Northwest Forest Plan

C. Moyer, K. Gallo, S. Lanigan

Aquatic and Riparian Effectiveness Monitoring Program

USDA Forest Service

Bureau of Land Management



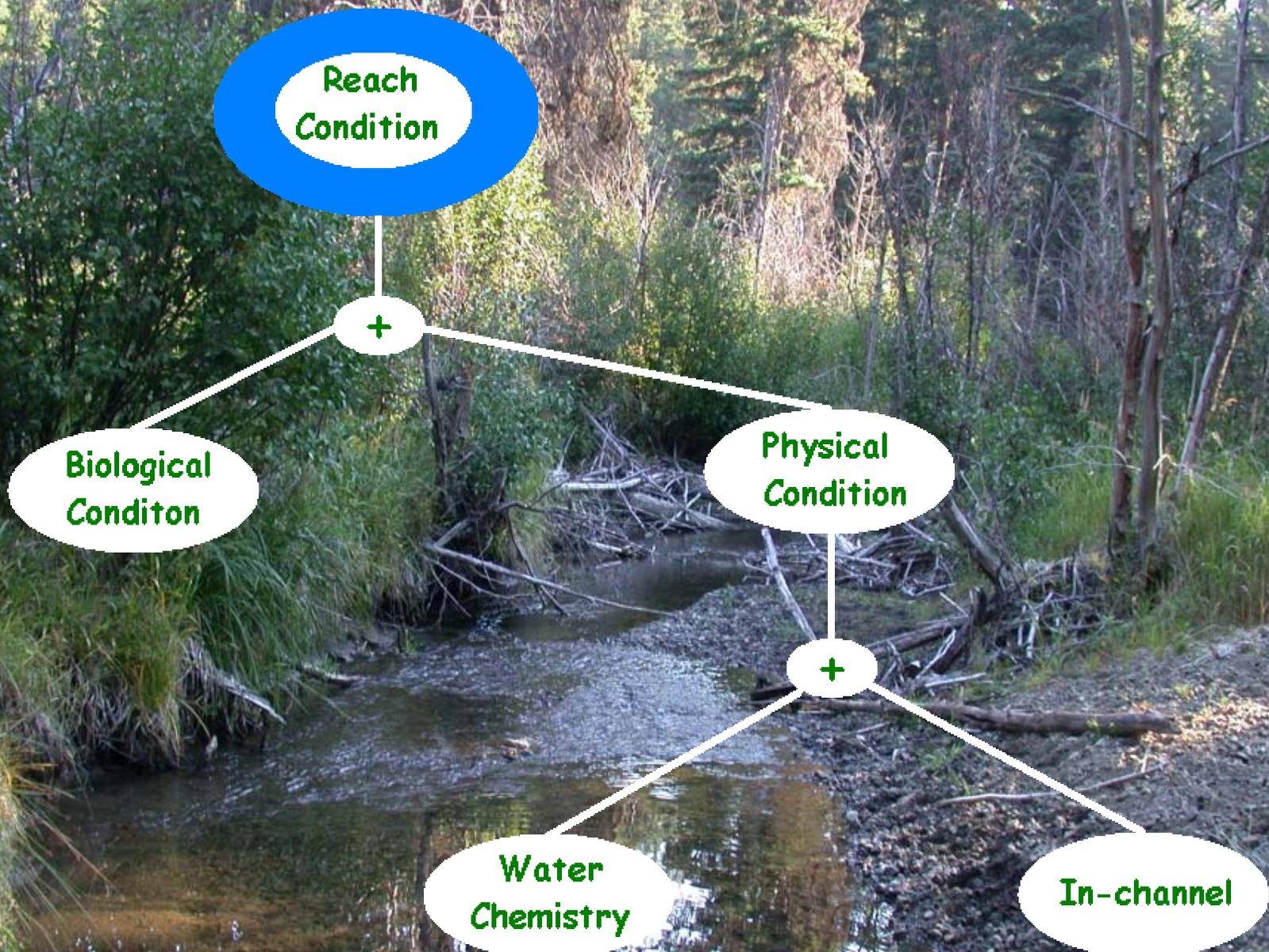
Overview

- ★ 3500 6th field HUC's
- ★ Sample 250 within 5 years
- ★ Sample 6-8 random reaches within each HUC
- ★ Decision Support Model
 - ★ Structure
 - ★ Evaluation Criteria
 - ★ Operators
- ★ Ecosystem Management Decision Support



Decision Support Model (DSM)

- ★ Logic based modeling
- ★ Gives each reach a Score
- ★ Reach evaluations are passed up to the watershed model
- ★ Switches
- ★ Weighting Factors



**Reach
Condition**

+

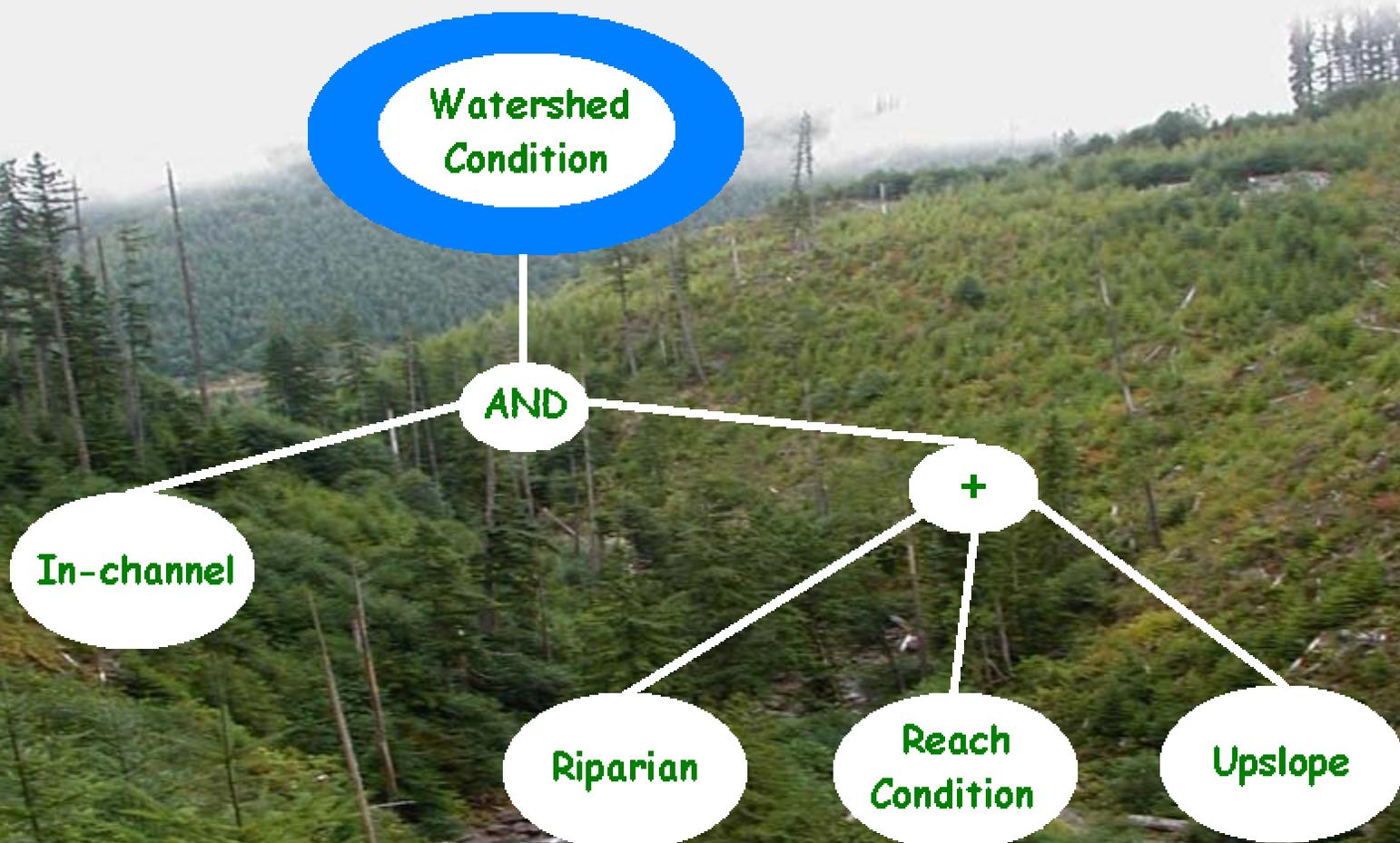
**Biological
Condition**

**Physical
Condition**

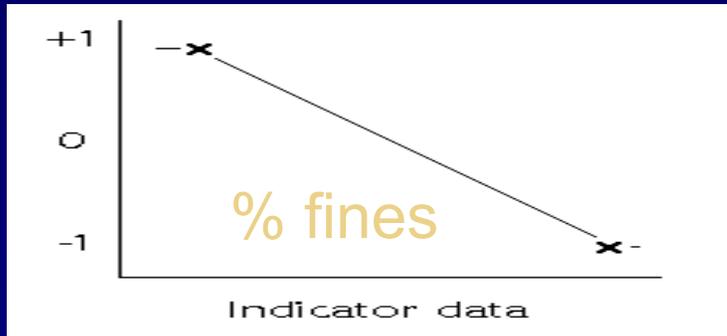
+

**Water
Chemistry**

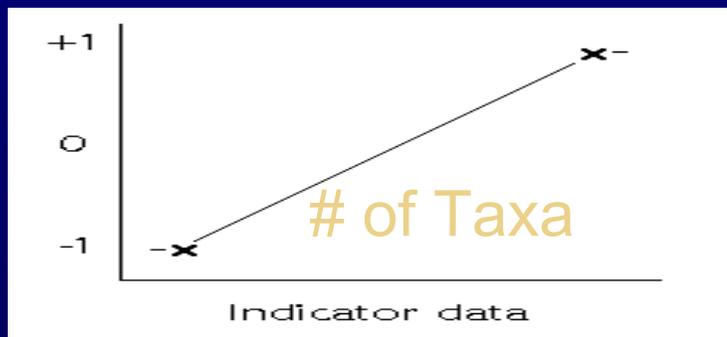
In-channel



Two-Criteria Evaluation

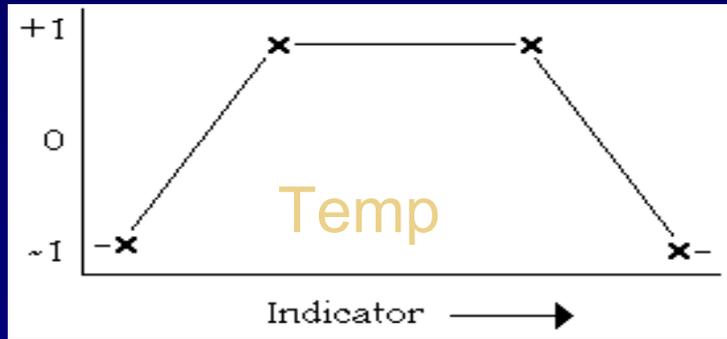


- ☀ Data that fall between the “poor” and “good” criteria are assigned a value between -1 and $+1$

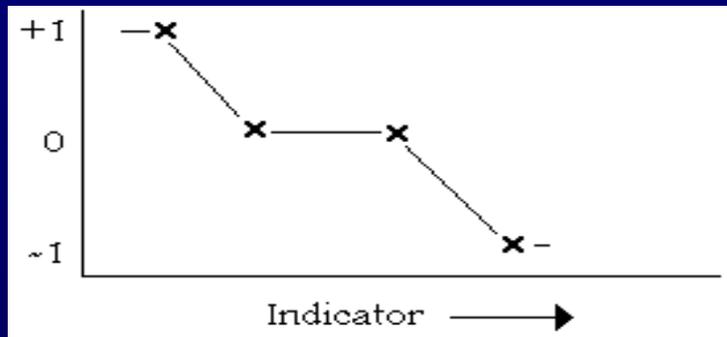


- ☀ Relationship may have a positive or negative slope

Four-Criteria Evaluation

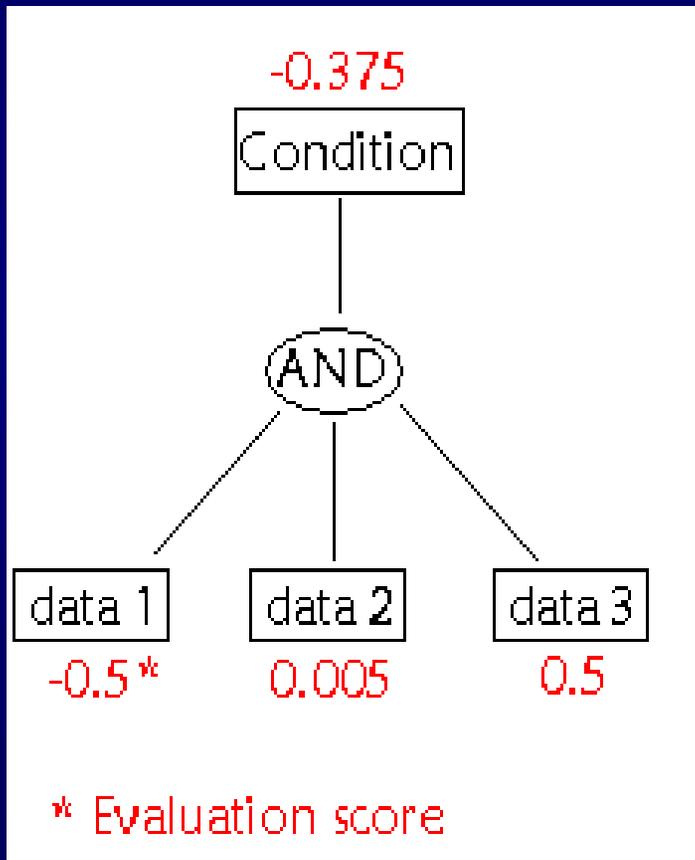


- Indicator data that fall within range of “good” criteria are assigned value of +1



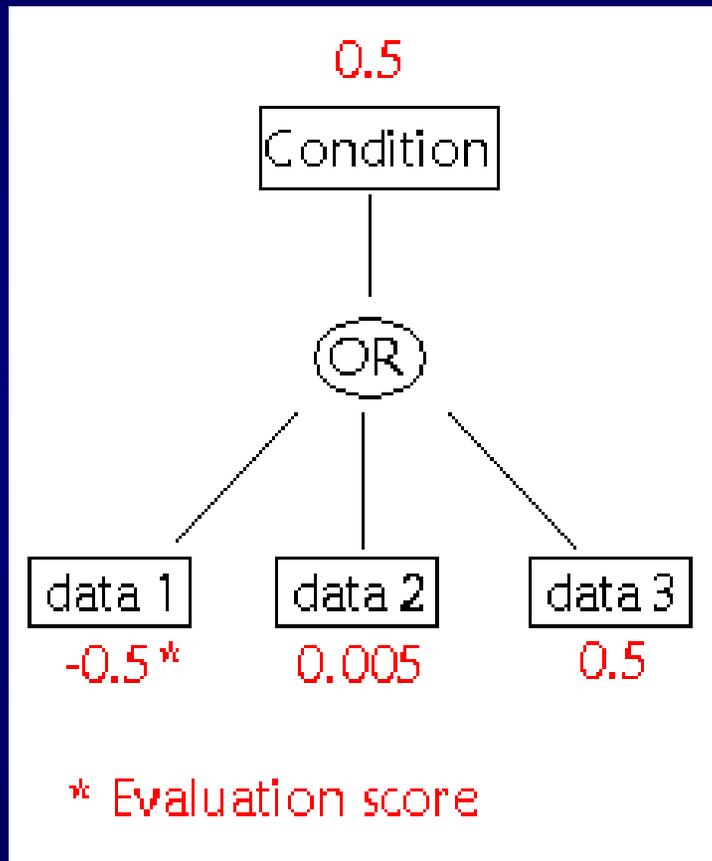
- Data outside range of “good” criteria are assigned value between -1 & +1

AND Operator



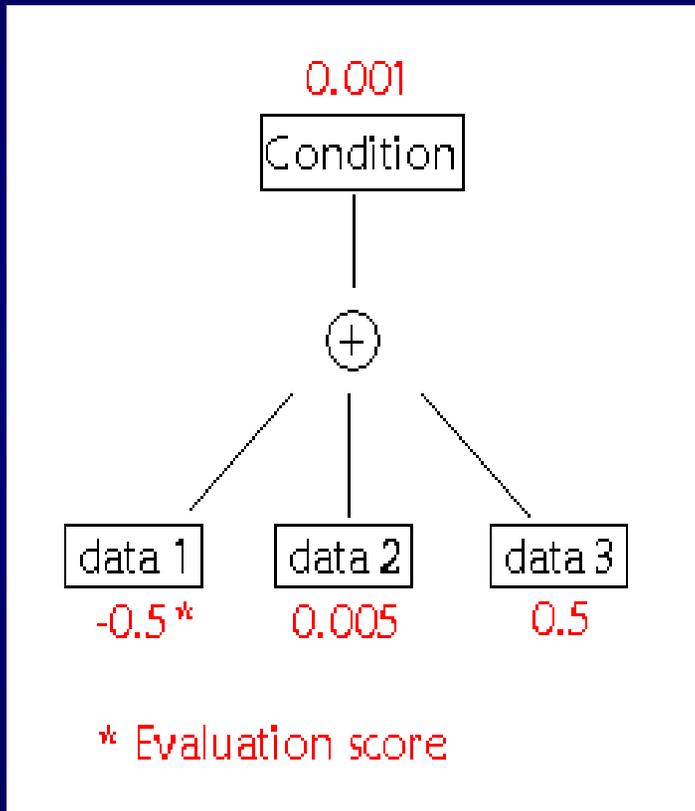
- ★ AND operators pass a score weighted towards the lowest evaluation score
- ★ AND is used primarily if one indicator is more important than others (e.g., temperature)

OR Operator



- ✦ OR operators pass the highest evaluation score
- ✦ Presents an optimistic view of condition

+ (Union) Operator



- ✦ + operators pass the average evaluation score
- ✦ + is used so that indicators in good and poor condition balance each other out



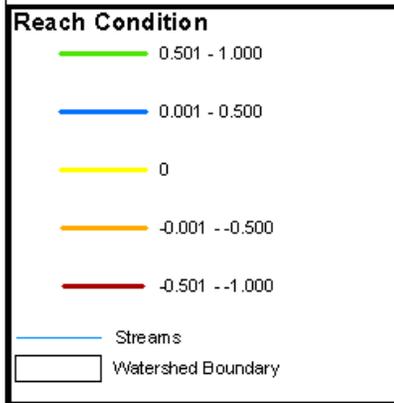
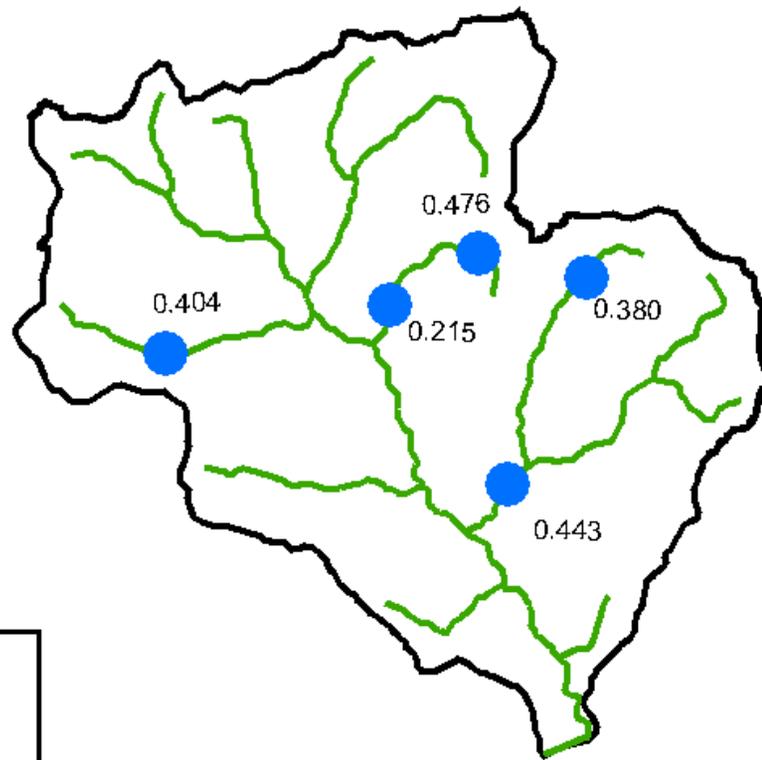
Model Development

☀ To date:

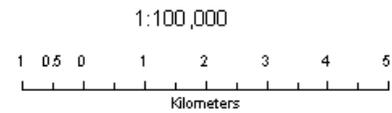
- ☀ Extensive literature review
- ☀ Input from outside sources

☀ Future:

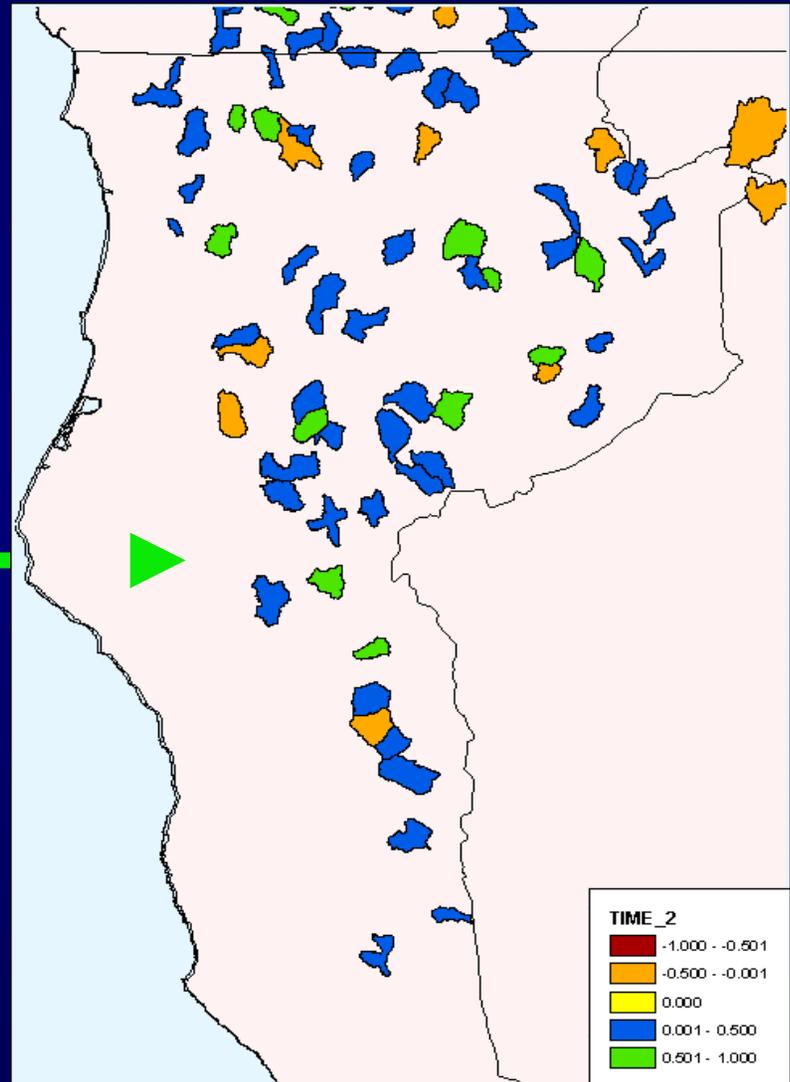
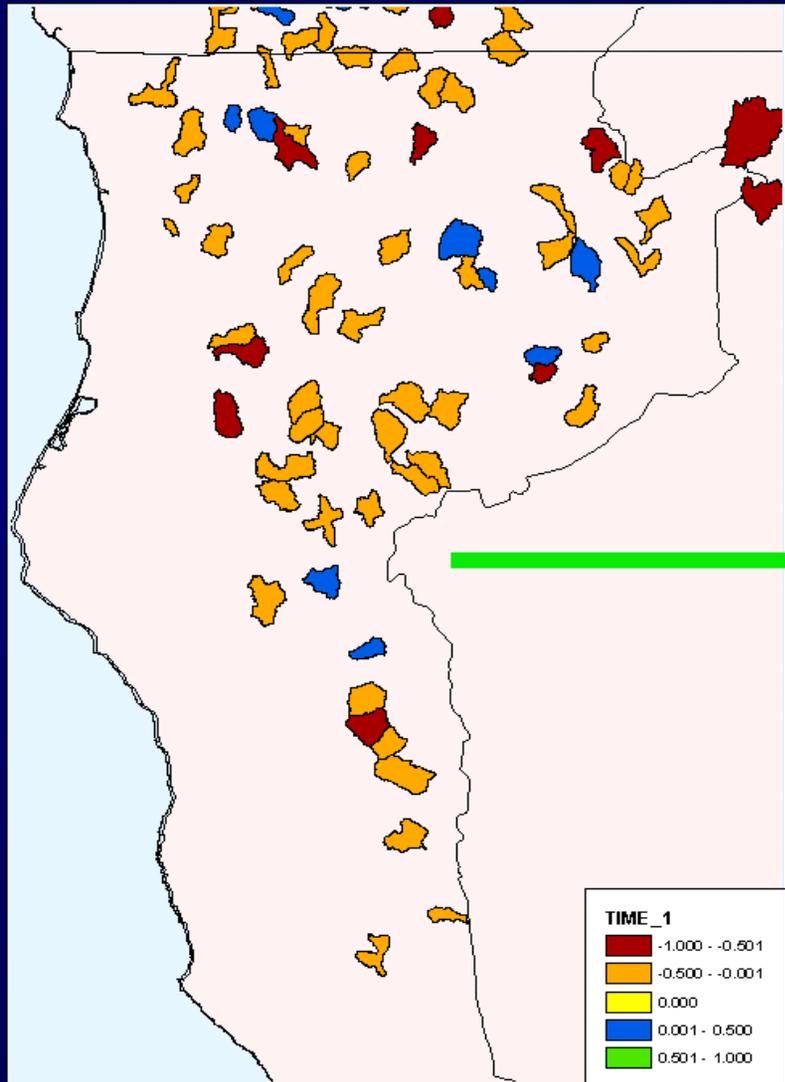
- ☀ Provincial Review Teams
- ☀ Local area input



USDA Forest Service
 Aquatic & Riparian Effectiveness Monitoring Program
 4077 Research Way
 Corvallis, Oregon 97333
 February, 2002



Watersheds - Spatial



Conclusions

- ★ Changes in evaluation score distributions through time (across Northwest Forest Plan)
- ★ Changes in individual indicator values through time (within watershed)
- ★ DSM/EMDS tools for aggregating different information types
- ★ Real Evaluation criteria are challenging to get
- ★ Rule sets (operators) are challenging to determine